



# Installation Guide pureFAMILY



## Content

Installation manual and description of the pureFAMILY product platform. Addresses functionality, detailed technical description, and a complete description of how the system is installed.

**pureSignal**

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## Installation Guide – pureFAMILY

Date	Product	Comment
2023-05-05	pureFAMILY	UPDATE 2024-05-24



The pureFAMILY product documentation and pureSignal app is currently only available in English.

## General description of pureFAMILY product platform

### General description

pureFAMILY platform is a collection of sensors, gateway and software services delivered from pureSignal of Sweden AB.

The platform consists of:

- Sensors – pureMEMS, purePULSE more sensors will be published 2024.
- Gateway – LoRa to Ethernet, WiFi or LTE
- Application Software – pureSignal (mobile and desktop app for presentation of data and configuration as well as integration to Rest API).

New products and additional sensors will continuously be developed to complement the pureFAMILY. All existing products within pureFAMILY can remotely be updated.

Please contact your distributor or just send an e-mail to [info@puresignal.se](mailto:info@puresignal.se) for more info.

Datasheets and other general information are published on the website [www.puresignal.se](http://www.puresignal.se).

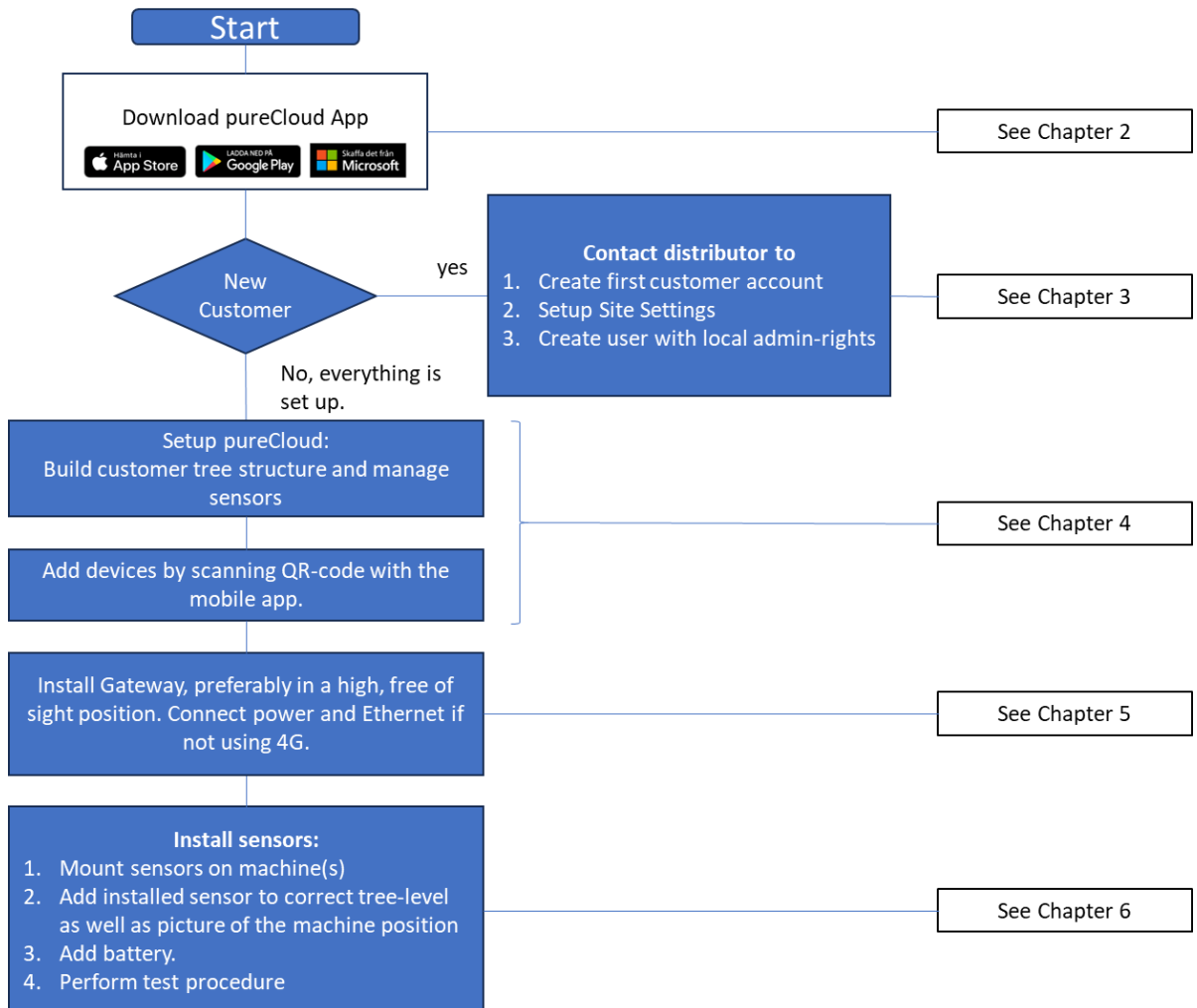
Support and service questions can be sent to [service@puresignal.se](mailto:service@puresignal.se) and sales questions to [info@puresignal.se](mailto:info@puresignal.se).

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# 1. Installation - the big picture

Below is an overview of the different installation steps needed to get started with wireless monitoring of your facility.



## 2. Wireless Data Communication

### 2.1 LoRa radio

The data is transferred from sensors to Gateway with LoRa radio communication. LoRa (Long Range) is the radio signal that carries the data, and LoRaWAN is the communication protocol that controls and defines how the data communicates across the network.

The main advantages of LoRa radio are that it provides low-power, wide range, and cost-effective connectivity for devices that don't require high data transmission rates and it's a great option when cellular is too expensive or Wi-Fi coverage isn't available.

#### Some of the best uses are:

**Agriculture:** With a long range that provides reliability in rural applications for devices that do not have a high data transmission rate, LoRaWAN perfectly supports agricultural use cases.

**Assets and logistics:** Network-based location and tracking abilities at a low cost and optimized battery life make LoRaWAN suitable for assets and logistics.

**Smart metering:** LoRaWAN's ability to reach sensors monitoring utilities located underground make this a well-suited connectivity choice for smart metering.

**Smart home:** The ability to pass through obstruction, such as walls, and ability to support battery powered, low data -consuming applications that can be used in smart homes make this connectivity option appealing.

**Healthcare:** IoT solutions comprised of LoRa-based hardware can monitor high-risk patients or systems 24/7, ensuring health and medical safety are comprehensively managed.

**Industrial:** Industrial IoT is transforming operations by digitizing legacy processes and equipment, driving profits, keeping costs lower, and maximizing efficiencies. LoRa-enabled devices and sensors take real-time data to provide key insight into predictive maintenance, machine health, efficiency, reduced downtime, and much more.

pureSignal sensors must use a gateway from pureSignal for fully functionality and be able to manage sensor settings like alarm levels, tree structures etc. However, with some manual customizing the sensors can be able to send data both to pureSignal gateway and other already existing LoRaWAN network if requested but then with limited functionality (one way data transfer) and without possibility to remotely download firmware and update settings. For best performance pureSignal don't recommend using pureSignal sensors with a 3rd party gateway because of the limitations and the lack of ability to update the firmware.

Request to upload data starts from the sensor asking for permission to upload to pureCLOUD via gateway. If permission is granted, uploading continues, otherwise the attempt is stopped, and a new attempt can be made later.

The next step is that the device sends test packets in different radio modes to test reception, and the gateway asks for the mode with optimized signal strength. The three different modes being used are (1) DR7 (also known as FSK), which is the fastest but also has much shorter range; (2) DR6, which is slower but has better range; and (3) DR5, which is the slowest rate but has much better range. In good condition outside (open air or line of sight) the distance can be up to 20km. If no radio mode is good enough, radio transmission is interrupted to save battery until a gateway is available within range.

The sensor uploads all data, and the gateway may ask for increased transmission strength and/or lower DR if signal strength seems poor. If contact between the sensor and the gateway is lost for too long, the upload will be aborted completely.

When the upload is successful, the data is saved in pureCLOUD and visualised in the application or accessed via an open API. If the upload is interrupted or fails, it will be redone with an adjustable delay (default 5 minutes) and an adjustable number of times (including the first one, default 12).

An upload with default settings (measuring three axes for 5 seconds) takes approximately 1-2 minutes in DR7, 3-4 minutes in DR6, and 7-8 minutes in DR5.



*pureSignal sensors are ONLY able to be installed in LoRa radio network in Europe using frequency band 863-870 MHz. Please send request for sensors with frequency ranges for other markets. [info@puresignal.se](mailto:info@puresignal.se).*

### Radio channels

pureSignal primarily uses standard LoRa channels, with some modifications. Relevant legal text is document 2017/1483/EU, specifically bands 47, 48, and 54.

Channel	MHz	DR
0	868,1	0 – 5
1	868,3	0 – 5
2	868.5	0 – 5
3	867.1	0 – 5
4	867,5	0 – 5
5	867,7	0 – 5
6	867,7	0 – 5
7	867,9	0 – 5
8	868,3	6 (250 kHz BW)
9	866,9	7 (FSK)
<b>Fallback</b>	869,525	0

## 2.2 OpenAPI integration

For these customers that would like to read data from their own sensor pureSignal offer openAPI implementation direct from pureCLOUD. This makes it possible to create an own customized visualisations or integration to an already existing system. Both pureCLOUD and the optional add-on software pureCLOUD expert reads in same way via openAPI. Accessible data are trends, time waveforms, machine pictures and more. Full API documentation is available for authorized users.



*Please contact pureSignal for API documentation. To be able to make an API connection a special user account must be created. Send e-mail to [info@puresignal.se](mailto:info@puresignal.se).*

## 3. Download pureSignal application

pureCLOUD application is available on following platforms:

- iOS - App Store
- Microsoft Store - Microsoft Apps
- Android Apps on Google Play

Search for: pureSignal



**iOS - App Store**



<https://apps.apple.com/se/app/puresignal/id6470798306>

**Microsoft Store - Microsoft Apps**



<https://www.microsoft.com/store/productId/9P2R6CC11XDD?ocid=pdpshare>

**Android Apps on Google Play**



[https://play.google.com/store/apps/details?id=com.x2wireless.PureSignal&pcampaignid=web\\_share](https://play.google.com/store/apps/details?id=com.x2wireless.PureSignal&pcampaignid=web_share)

## 4. Customers and user accounts

pureSignal recommend that all *new customer account* and *local admin* user are created by local distributor or in contact to pureSignal support. Additional users can then be created by local customer admin account. It's preferred that at least one customer account has local administrator authentication. Admin account can change settings, create- and administrate other local users. Software settings like sensors configuration, build up the tree hierarchy and create new sites are also possible for local admin.

Required customer information for setting up new customer:

- *Customer Name* to be visualized.
- *Customer Sites* to be visualized.
- Main contact person full *Name*
- Main contact person *e-mail*
- Main contact person *phone number*

Push message like alarms or other related message can be pushed to app, sms and/or e-mail. This information may be entered if the account would like to receive notifications.



*User password can be reset on logon page.*

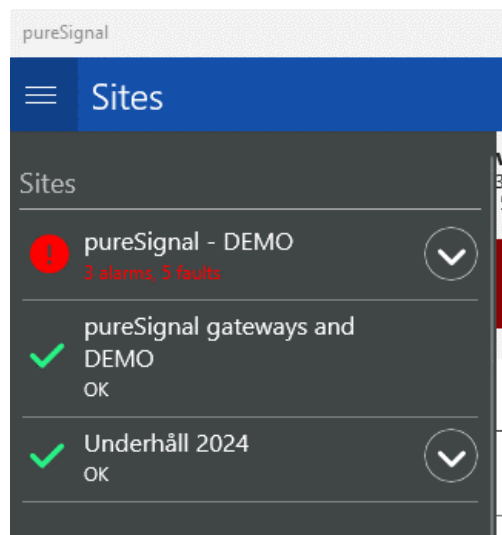


## 5. Setup of pureSignal app

Use your login details to log in to application pureSignal. To make changes for settings in this guide your account must have administrative rights, see chapter 4. Local distributor can create new customer account and local administrator to be able to handle local support. Customer level in application is the highest level and underneath each customer it's possible to add multiple sites, sensors, and users. A given user account can be a user in more than one customer and have different authorisation level in each of them.

### 5.1 Own sites/ guest sites

In the top left corner you will see *Sites*, these sites are your own local sites and are related to your own customer. Underneath you will find *Guest sites*, these are sites that your account has been invited to, perhaps by using an invitation code created by someone that have access to the other site. A user account can have different authorisation level on each site depending on the settings for that user. The authorisation levels are *Guest*, *Tech User* and *Customer Admin*.



Own sites

### 5.2 Customer and user settings

The settings for customers and users are located by clicking on the gear icon on the main page. See picture below and use backward arrow to step backwards in application to get to top main menu.

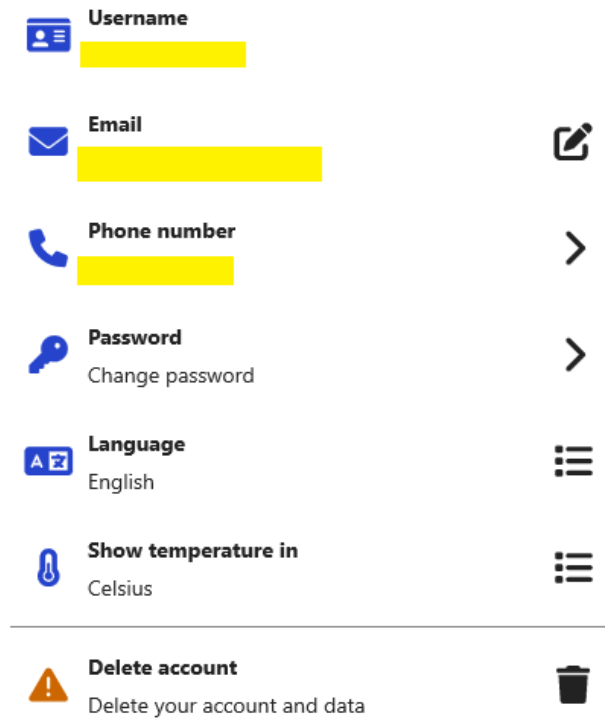


Customer and user settings

Most of the general settings are located here.

**Account:**

**User settings:** Here are the settings for your own account like e-mail, phone number, language, and password. It's important to enter phone number and e-mail if you would like to receive alarm notifications.



Customer and user settings

**Alarm settings:** Alarm notifications are configured manually for each account and has several different options. Please observe the name of selected site before a new alarm notification is created. If an alarm should be added from another site, please select that site first before you go to alarm settings. The name of actual selected site will be present beside the text. Alarm notification can be sent to app (push), email and/or SMS. Observed that each customer has a maximum number of sent SMS and e-mail per month included in the pureCLOUD subscription.

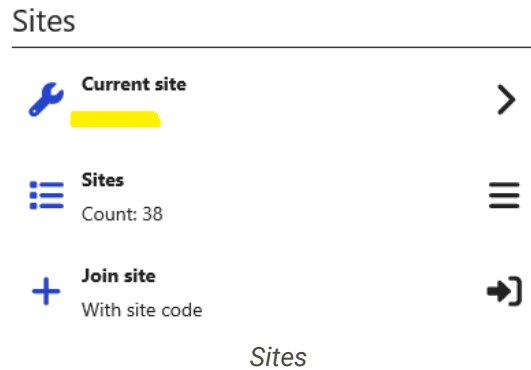
Following picture shows an example of an alarm notification.



Alarm notification.

**Sites:**

**Current site:** This is the actual selected site. Here it's possible to edit information like site name, address, and GPS location. It's also possible to add or remove sensor and create the tree hierarchy for this site. See section 5.3 – 5.5 for more info.



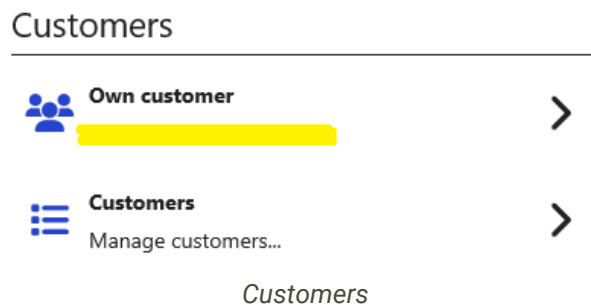
**Sites:** Select another site that your account already has access to.

**Join site:** Join other sites to your account can be both new own customer sites and guest sites. This requires a site code created from requested site. Your account can have following permission levels in sites: Alarms only, simple info, detailed info, or full control.

**Customers:**

**Own customers:** This is the actual selected customer. Here it's possible to edit actual selected customer. Change information for this customer or add/edit user accounts and sites.

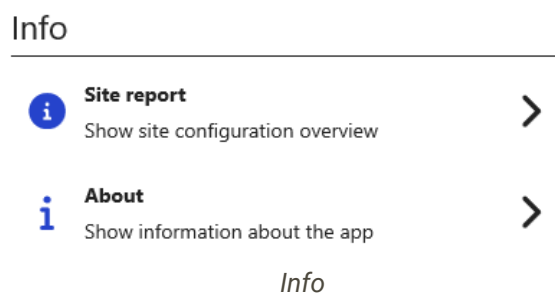
**Customers:** Select another customer that your account has access to. Customers to guest sites can't be edit.



**Info:**

**Site report:** A quick summary of actual selected site.

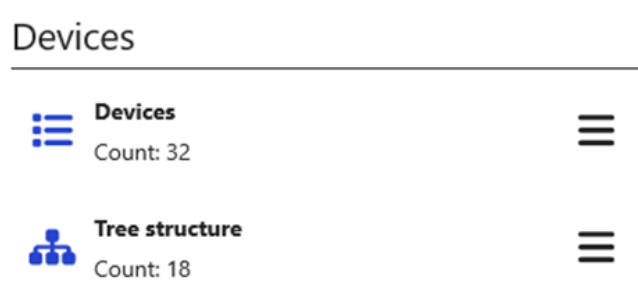
**About:** See actual version of installed pureSignal application.



### 5.3 Customer tree hierarchy

Go to “Current site” (see section 5.2) to edit the settings for devices or tree structure. Please observe that you have select correct “Site” else you will have to find the correct site from “Manage Customers”.

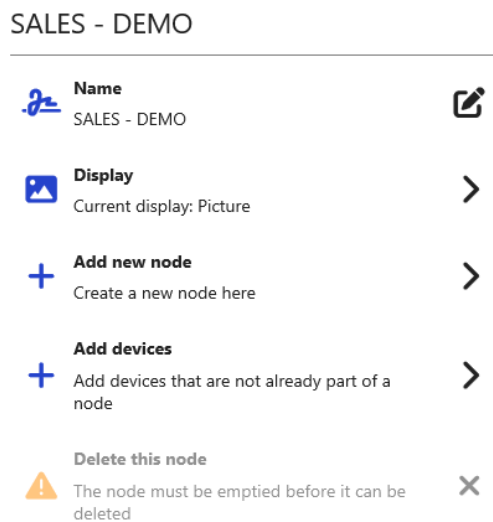
**Devices:** Devices shows all devices/ sensors for the selected site. A requirement is that the devices are scanned/ connected to the customer before these can be moved to a certain node in the hierarchy. When the sensors are scanned, they will be found in a global customer “pool”.



Devices

All devices must be removed from a node before the node can be deleted. These sensors will be transferred to global customer “pool”.

**Tree structure:** This is the configuration for a specific tree hierarchy. Top level text shows the site name and from this level you can create new nodes underneath. A node can just be a text for a certain tree level or a machine name. Click on a certain level and select “Add New Node”. Each new level can have other nodes beside or underneath. For visualisation in the app a geographic point on a map or an own uploaded picture can be associated to that node.



Node settings

Sensors and nodes can be added in this view. More information will follow in next section.

## 5.4 Manage pureMEMS and purePULSE sensors

Brand new sensors must first be “scanned” before these can be found in the pureSignal app. After they are scanned, they will be located in top hierarchy level of that customer this is also named as customer pool. The very first step is to scan the QR-code with a mobile camera using the app pureSignal. It’s not possible to add or scan sensors from PC application.

With your mobile device, go to settings and select the actual site there the sensors should be added. Continue to “Devices” and “Scan QR code”. The option “Scan QR code” can only be found in mobile devices and a QR code may be found on all pureSignal products.

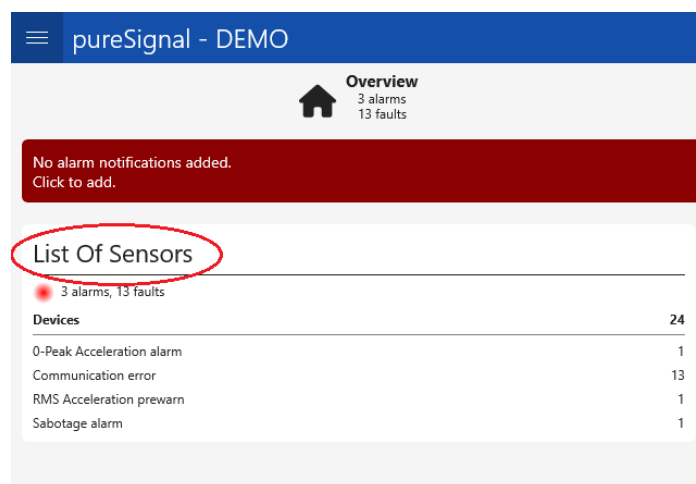
Sensors can be scanned one by one or by using the option multi-scan to add more sensors at same time. For each sensor that is scanned, a green box will appear along with a low beep next to the scanning square. If the box doesn’t turn to green, it depends on, the sensor can’t be added for some reason. It may be caused by the sensor is already attached to that customer or any other customers. Locate the sensor by searching for it and manually move it to the site there it belongs. It’s recommended to give the sensor a name at same time they are added. If no name is entered, the sensor will have same name as the serial number. The name can be changed later in the software. Observe that shortest name is 3 signs long.

All newly added sensors will initially be placed in the top hierarchy level of the selected customer. If the sensors are mixed, use the standard mobile camera over the QR code and the serial number will be displayed on the screen.

Continue from section 5.3 and select “Add devices”. Add device means that the sensor will be moved to the desired location in the tree. Other pureSignal products like pureGATE can also be moved around in tree structure. It’s a recommendation to move gateways to a location close to the other sensors in the hierarchy for better understanding.

## 5.5 Sensor settings

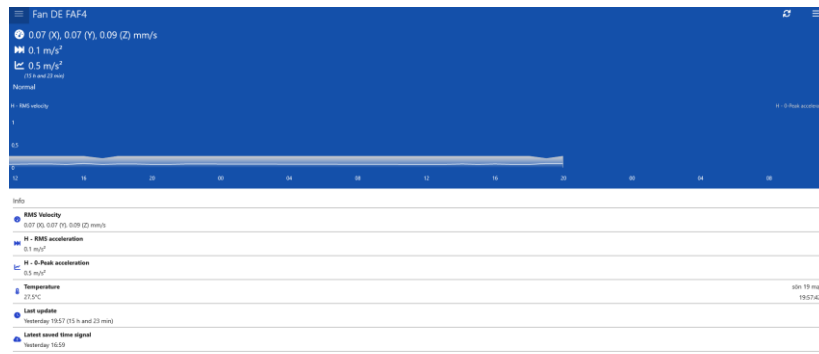
Go to main top view of the application. The tree hierarchy, for all sensors, are visualised underneath “List of Sensors” in this picture.



List of sensors

Click on the text, “List Of sensors”. But this text is changeable in site settings so it may be different in your application. Go to site settings, see previous content in this manual, and search for *site description*.

Just select anyone of the sensors in the sensor list. The sensor page will view a trend graph at the top of the page and underneath some of the measurement results and other sensor information.



Sensor view

Click on the icon in the top right corner of the page with three horizontal lines. In this menu it's possible to name the sensor and make all sensor settings. Depending on your site authentication and the sensor type the list will be different.

Initial value will be presented inside brackets, like [-10°].

Lines marked with a \* are settings that require higher authorisation levels for the user account.

**General:**

Name	Name of the sensor
Third-party integration*	pureCLOUD Expert/ FRT - Asensiot/ Multiviz – Viking Analytics. These are Open API add-on options.
Subscription pureCLOUD*	Sensor end usage date. End date for use of data storage and of all add-on software. Please contact your distributor or <a href="mailto:info@puresignal.se">info@puresignal.se</a> if this will occur. By default, all sensors have unlimited subscription but can in exceptional cases have limited subscription.

**Placement:**

Placement	Free text for placement.
Measure position	A list that follows ISO standard name of different sensor positions. This information is used by API integrations like Artificial Intelligence.
Z-axis direction	Selection of real sensor mounted direction. Horizontal, vertical, or axial direction. This information will be visible in pureCLOUD expert or other API integrations for all directions.
X-axis direction	Selection of real sensor mounted direction. Horizontal, vertical, or axial direction.
Y-axis direction	Selection of real sensor mounted direction. Horizontal, vertical, or axial direction.

**Trends:**

Sensor mode*	Sensor selection. pureMEMS 1D-TOP, pureMEMS 3D-SIDE or purePULSE. (pureMEMS 1D-TOP is available in some market)
Trend measurement interval	[180 min] Measurement interval for trend measurement of purePULSE and pureMEMS. After fulfilled measurement data will be transferred. (purePULSE can also locally store data between this interval.) <i>This setting is locked if synchronized measurement is active.</i>
HP-filter trend meas. velocity	[10 Hz] High pass filter for velocity trend. 2Hz or 10Hz.

HP-filter trend meas. acc.	[10 Hz] High pass filter for acceleration trend. 10Hz or 500Hz.
Trend measurement direct.	[XYZ] Measurement direction. XYZ, X, Y or Z.
Trend value settling time	[1000ms] Settling time before start of measurement.
Trend value measuring time	[1000ms] Measurement time.
Synchronized measurement*	Synchronization time stamp for trend measurement. <i>This setting is locked if synchronized measurement is active.</i>

#### Time signals: (only present for pureMEMS)

Time s. meas. upload interval	[0 hour] Time between raw time signal measurement. <i>This setting is locked if synchronized measurement is active.</i>
Time s. scheduled time	[12:00] Actual time stamp to trigger measurement of raw time signal. <i>This setting is locked if synchronized measurement is active.</i>
Time s. scheduled day*	Not in use.
Time s. scheduled weekday*	Not in use.
Time Waveform length	[2000ms] the length of the measured raw time waveform.
Time waveform mea. direct.	[XYZ] Measurement direction for time waveform.
Sampling frequency	[12800Hz] Sampling frequency of time waveform. 12800, 16384 or 25600Hz. Maximum sampling frequency is 25600Hz. (Resampling of 12800Hz and 16384Hz will be perform inside sensor to safe data transfer time.)
Upload attempt interval	[5 min] Time between every attempt to upload time waveform to gateway.
Upload attempts	[12] Number of attempts to upload time waveform before this is cancelled.
Blocked measurement time*	[120 min] Blocked time between two time wave forms.

#### RPM (Rotation per Minute): (this is only present for purePULSE sensor)

*(The purePULSE sensor has an interrupt feature to wake up at the first registered pulse, if the machine starts to rotate)*

Interval between mea.	[600 sec] Time between each recorded measurement. Recorded data history will be transferred all together in same interval as setting "Trend measurement interval". This interval time is the first possible time at which the sensor can register that the machine has stopped. A shorter time will give a more accurate calculation of operating time but will instead give shorter battery life.
Minimum pulses for RPM mea.	[25] Number of pulses that has to be achieved to calculate. RPM value. Depending on rotation speed of the machine this can be changed.
Number of mea. points per rev.	[1] Number of trigger points from magnet/-s per revolution.
Deviation level for RPM mea.	[5 RPM] Minimum deviation level between two measurements that must be fulfilled to store recorded data. If deviation is lower than the threshold the data will be erased and won't appear in history trend in pureCLOUD.

#### Alarms:

Upper alarm limit RPM	[Disabled] Upper alarm limit RPM.
Lower alarm limit RPM	[Disabled] Lower alarm limit RPM.
Automatic time s. triggering	[OFF] Trigger measurement tasks for time waveform.
Alarm thresholds	[NAN] Trigger thresholds based on trend tasks.
Lower alarm limit temperature	[-10°] Lower alarm limit for temperature alarm.
Upper alarm limit temperature	[85°] Upper alarm limit for temperature alarm. 85° is the highest acceptable temperature for pureMEMS and purePULSE.

Alarm limit battery voltage [2,80] Lower alarm limit for battery voltage. Recommended threshold is 2,80 voltage.

**Interval:**

Timeout [1440] Sensor communication timeout. Specified in minutes and will result in communication error notification in pureCLOUD.

**Technical info:**

This is just a part of the technical information around the sensor. More information can be found in section LoRa Network in section 2.

Latest configuration data Latest transmitted time stamp for sensor data configuration.  
 Latest SF SF7 – SF12. Band SF7 represent the strongest and fastest transmitted time between sensor and gateway. SF12 is the slowest SF band but compared to SF7 this band performs the longest radio range.

Measurement blocked Number of blocked time waveforms.

Resends Number of resent time waveforms.

Upload pending Upload pending of time waveform.

## 5.6 Synchronized measurement

Sensors in same level in app can cooperate in a group of sensors. This is also named in as synchronized measurement this installation guide. Brand new sensors will work by default as single sensors and sensors that should act synchronized must therefore be configured. The activation for synchronized measurement is configured in same tree level as the actual sensor location in the sensor list. An icon will be found in top right corner, three horizontal lines, and the name for the setting is "Linked group settings".

Synchronized measurement is included in sensor version 3.5 and upwards and pureCLOUD version from 2.17.

..upcoming picture..

**Synchronized measurement features:**

- Trends will be measured with same time stamp and at the same interval. The settings named "Trend interval" and "Scheduled time for trend measurement" are used for this feature and will then be disabled in a single sensor settings.
  - o Trend interval: Trend interval
  - o Scheduled time for trend measurement: Start time stamp for trend measurement
- Time waveform will be measured at same time stamp and have same measurement interval. A specific start time stamp can be entered. Settings named "Time signal interval" and "Scheduled time waveform" are used for this feature and will then be disabled in a single sensor settings.
  - o Time signal interval: Time signal interval.
  - o Scheduled time waveform: Start time stamp for scheduled time waveform.
- Triggered alarm from one sensor threshold will trigger time waveform measurement for all sensors inside the group. Observe that all sensors are "sleeping" between each task which means that the time stamp will occur next possible time.
- A specific synchronized RPM value will be measured at the beginning of a scheduled time waveform, if purePULSE sensor is included in the group. Actual RPM value will be present in pureCLOUD expert as a process data value attach to same triggered time waveform.
- A minimum RPM level, named "RPM Release Condition Time waveform", will control if time waveform should be triggered or not.



- RPM Release Condition Time waveform: Minimum RPM value to release time waveform measurement.
- Manual trigger time waveforms from all pureMEMS in same group. Observe that all sensors are “sleeping” between each task which means that the time stamp will occur next possible time.

## 5.7 Sensor status

The software can display text notifications in pureSignal app depending on the sensor status. These notifications can be found in different views in the application. Depending on the severity of the message it will have different font colours.

### Active status - list of examples that can be present:

- **Everything is normal/ normal:** Sensor works in normal condition based on last measurement.
- **Communication error:** The sensor is currently not sending any data.
- **Temperature alarm:** Temperature alarm.
- **RMS Velocity pre-warn/ warning/ alarm:** RMS Velocity pre-warn/ warning/ alarm from last measurement compared to threshold limits.
- **RMS Acceleration pre-warn/ warning/ alarm:** RMS Acceleration pre-warn/ warning/ alarm from last measurement compared to threshold limits.
- **0-Peak Acceleration pre-warn/ warning/ alarm:** RMS Acceleration pre-warn/ warning/ alarm from last measurement compared to threshold limits.

Technical information concerning signal transmission can be found in section sensor settings.

## 5.8 Presentation of measurement result

pureSignal app include presentation of graphs from one or more measurement in same view. Alarm thresholds and averages are possible to view or hide in the graph. As an add-on software, pureCLOUD expert can present measured data from pureSignal sensors as a higher expert software that include presentation of FFT, time waveform and cross selections of data. Please contact your distributor to get access to pureCLOUD expert.

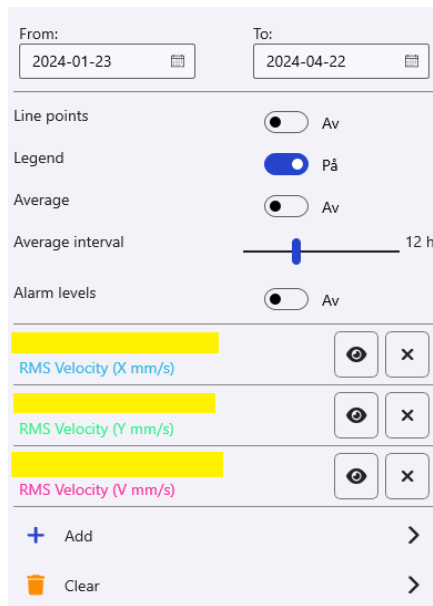
### View sensor data:

Go to a free selected sensor or click through the software to the main view. The icon for trend presentation can be seen in picture below. Different trends can be presented from actual sensor in the graph.



Trend icons

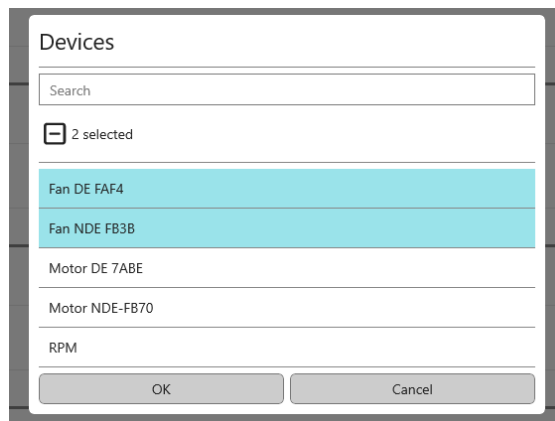
Find the three horizontal lines in the upper right corner. A new view will show filters for the graph view. All selected measurements will be listed one by one underneath the filter options. Each measurement can temporary be hid and other measurement from other machines can be included in the graph view.



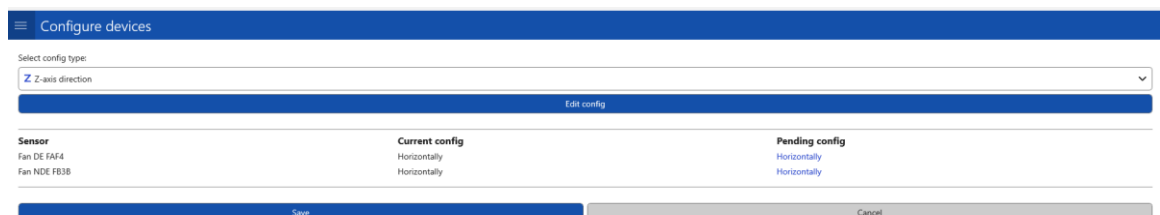
Graph filter

## 5.9 Multi-edit of sensors

Multi-edit is a feature in the software to edit the sensor settings for more than one sensor at the same time. Observe that only settings that are common to the selected sensors will be able to be changed simultaneously. The settings which are not common will not appear in “Edit config”. This function can be found in sensor list in the top right corner. The icon looks like two gears. The pictures below show examples of how this is configured. Remember that all sensors setting will be transferred next possible time when sensor is awake. Don’t forget to save your settings afterwards.



Select devices for multi edit



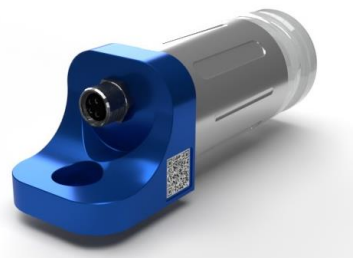
Multi edit view

## 6. purePULSE sensor

purePULSE sensor measure a true RPM value based on the shaft rotation speed. The package of the purePULSE sensor contains of purePULSE sensor, sensor cable and trigger magnet. The purePULSE sensor has an in-built magnet that can easily be attach to a magnetic surface. As an alternative the sensor can also be attach with M6 screw. The sensor trigger has a diameter of 8mm. The package also includes a trigger magnet, embedded in a sled, this sled must be attached somewhere on the rotating shaft.

The distance between M8 sensor trigger and the rotating magnet is up to approximately 15 mm depending on the magnet strength. Other types of magnets can also be used.

*Description of sensor settings can be found in previous chapter in this guide.*



purePULSE



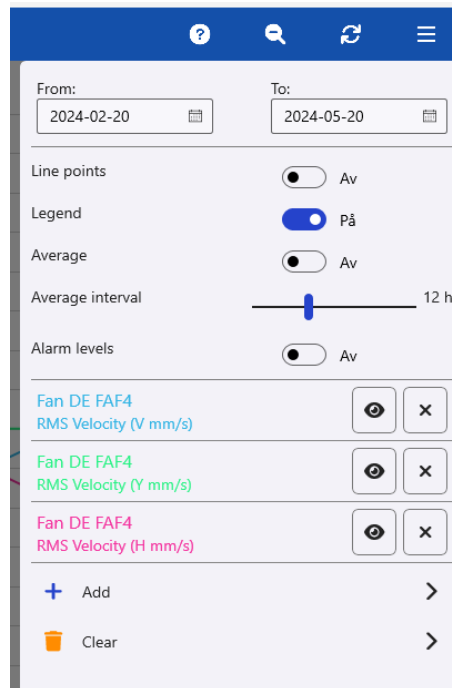
Sensor trigger

### purePULSE features

- Measure a true RPM value based on shaft rotating speed.
- Calculation of machine operating time in pureSignal app.
- Upper and lower alarm thresholds for notifications in app/ e-mail/ sms.
- Speed ratio calculation of the number trigger points per revolution.
- A part of synchronized measurements in cooperation with other products in pureFAMILY.
- Wake up feature on first shaft rotation.
- Minimum limit of RPM speed for control of other sensors in pureFAMILY.
- Changeable delta value for data reduction.
- Sensor local storage of history data between transmission polling intervals.
- Synchronized measurement at same time as other pureMEMS sensors in same group.
- Easy mounting and changeable battery.

## 7. Setup of pureGate

A specific gateway, named pureGATE, from pureSignal is required to transfer data between sensors and cloud. The products included in the delivery are gateway, LoRa-antenna, and a USB-C power adapter (5VDC 3A) suitable for the most common power sockets.



Graph filter

It's important to find a suitable installation position of the gateway to ensure good communication for both the LoRa radio network and WiFi or LTE network. The LoRa network is a long-range network and data can be transferred up to 5 km in open air. A recommended installation position is high up in the building. In larger buildings, we recommend installing two gateways to achieve best possible coverage of all sensors. One gateway in each end of the building. Sensor data will be transferred freely through any installed gateway from pure Signal.

The Gateway can also be ordered in an industrialized cabinet (IP68) if requested from your distributor.

If the sensors are mounted behind metal sheet or concrete walls the gateway must be located closer to the sensors. An external LoRa antenna with higher strength may also be needed in some cases. Please ask your local distributor. LoRa network is a long-range network and can perform signal transmission over much longer distances compared to Bluetooth or WiFi communication, but on the other hand has a lower transmission speed. One package of time waveform/-s will be transferred in around 20-180 seconds depending on data amount and distance to gateway. The standard data transmission time for a sensor with default settings is around 45 seconds.

The pure Signal sensors don't need to be attached to a specified gateway. The communication is automatically transferred through an available gateway. Therefore, LoRa network can ensure high availability of data transmission. Monitoring the number of sensors communicating via a specific gateway can be presented in pureCLOUD.

Recommendation is to have more than one gateway if the number of sensors are more than 50. This is to guarantee high availability of the data transfer with redundancy between gateways. The sensors will automatically transfer data via the best available gateway. There is no upper limit to

the number of sensors that can be transferred through a gateway. It depends on the signal strength and amount of data that should be transferred. More gateways are required if the number of sensors increases or if the gateway is to cover a large building.

## 7.1 How to setup the pureGATE

In most cases there it is not necessary to make any changes in the pureGATE. If DHCP local LAN-network can be used, no changes need to be made to the settings. Plug-in gateway into the power socket and connect the LAN cable and the gateway will be ready to use.

If the gateway is ordered with a pre-configured SIM-card from pure Signal the gateway can just be connected to power and will be ready to use. These SIM cards are securely protected behind a private network and automatically provide roaming data within EU.

### Following text will explain how to:

1. Change to static IP address.
2. Connect to local WiFi network.
3. Setup of own SIM-card.

### Do following steps for all changes of gateway:

- Download latest IP Scanner software from <http://www.foab.se/sip/>
- Run IP-scanner "as administrator".
- Connect gateway via LAN cable direct to PC. (Observe crossed LAN cable may be used depending on your hardware)
- Local IP: Select the network adapter in drop down list. This network card should have DHCP settings.
- Click "Scan for units"
- A list of found gateways will be presented.
- Compare the MAC-ID on the backside of gateway to the list.
- Double-click to open the gateway configuration.

#### 1. Change to static IP address:

- Use DHCP: Change to "No".
- Change IP Address.
- Click on "Send new settings".
- Restart gateway.

#### 2. Connect to local WiFi Network:

- WiFi Enabled: Change to "Yes" if local WiFi network will be used.
- Click on "Send new settings".
- Close "Unit Info" window.
- Wait until device is ready and confirm that the new settings are present.
- WiFi SSID: Select your local network and enter the password.
- Click on "Send new settings".
- Restart gateway.

#### 3. Setup of own SIM-card:

- Use GPRS: Change "Use GPRS" to Yes. (Even if Yes is already selected.)
- APN: Enter APN name and eventually login authentication.
- Click "Send New Settings".
- The gateway will try to connect to APN server and actual status will be presented below. This can take up to 5 minutes and eventually a restart will be required.
- By default, all gateway prevents of sending high data volume when SIM-card is used. This limitation will stop transmission of time waveforms if this is active.
- Got to tab: GWP and "Allow upload via Modem": "Yes or No"
- Click on "Send new settings".

- Restart gateway.

In the GWP status view, all connection will be presented.

## 8. Installation of pureMEMS sensor

### 8.1 Hardware installation

The pureMEMS sensors are either screwed directly into the surface of the machine or into an adapter which is then screwed or glued to the surface of the machine. The recommendation is to screw the sensor to the machine to get the best possible transfer of signal to the pureMEMS. The delivery of pureMEMS includes a screw, inside Europe M6x35 stainless steel. If desired also 1/4" 28 UNF x 1 1/2" as an option.

#### Mount to flat surface:

Find a surface on the machine that is flat enough for the sensor to be attached. The surface of the machine must have a diameter of approximately 10 mm for adequate signal transmission. If the surface is smaller, it will lead to poorer signal performance.

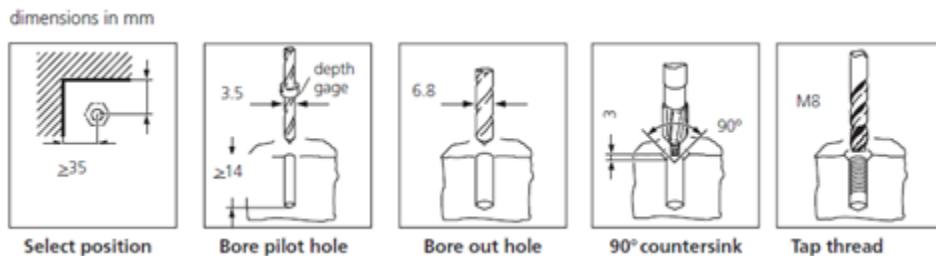
Use the supplied screw with M6 thread. Start by drilling a pilot hole with a 5 mm drill bit with a minimum depth of 8 mm. Thread the hole with an M6 threaded pin. Clean the threads.

Fix the sensor with the M6 screw and note the directions of the X, Y and Z directions to be entered in the pureSignal app.

#### Mount with M8 90° countersink:

Mount the sensor with M8 90° countersink to get a good signal transmission. Some machines already have pre-drilled holes of this type. From your distributor, you can order an adapter in the accessory list that fits between the M6 screw supplied and an M8 countersink type hole.

The pictures show an instruction on how to drill an M8 90° countersink hole.



M8 90° countersink hole

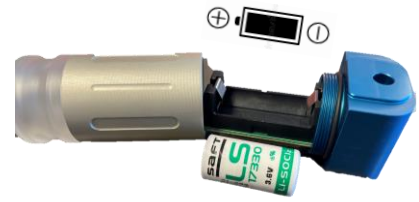
#### Extension adapters:

Extension adapters are also available in 50 mm and 100 mm lengths. Using an extension adapter may be the only way to mount a sensor in a certain position. Keep in mind that an extension adapter can negatively affect vibration results. For example, trends may show higher levels compared to actual values from the machine depending on the conditions. In the pureSignal app, you can manually turn off the X, Y and Z direction if desired to avoid misleading data.

## 8.2 Install the battery/ replace the battery

The battery type is 17330 and can be purchased from your distributor or from a local retailer.

Unscrew the tube from the sensor head. Carefully remove the old battery from the battery holder. Fit the new battery as shown in the picture. Check the condition of the seal before reinstalling the tube. Use hand force to screw the tube all the way in.



*Battery orientation*

The sensor will work differently if the battery is inserted for the first time or if the battery is replaced. If the battery is inserted for the first time, the sensor will immediately go into 'sleep mode'. Wake up the sensor by a manual trigger measurement with a magnet or wait for three hours with the battery attached. The sensor will then start sending data to pureCLOUD. If the sensor has already been activated, the sensor will automatically perform a trend measurement and then simultaneously update any new sensor settings from pureCLOUD. The result will be displayed in pureSignal app a few seconds after the measurement has been completed.



## 9. Test measurement to verify installation

The easiest way to verify the installation is to trigger a manual measurement using a magnet, see image below. This will perform a standard trend measurement and a test to verify the connection of the sensor to the cloud. This works for both purePULSE and pureMEMS sensors. The values from the sensor should be displayed in the pureSignal app.



### Test procedure

Hold the magnet against the end of the tube on the sensor. When the magnet is within the sensing range, the LED will light up solid blue. The magnet must be held for at least 5 seconds to trigger the trend measurement and time waveform simultaneously. If the magnet is held for less than 5 seconds, manual measurement is limited to trend measurement. purePULSE can only perform trend measurement.



#### pureMEMS:

*Numbers of triggered time signal per day can vary depending on sensor settings. This is a limitation for permitted transmission radio time in the LoRa network. Trend measurement will always be possible to trigger manual.*

*Time waveform (as default) will be measured in Z direction for 2 seconds with a sampling rate of 12,8kHz.*

*The default setting for trend measurement is set to:*

- *X direction: RMS velocity 10-1000Hz*
- *Y direction: RMS velocity 10-1000Hz*
- *Z direction: RMS velocity 10-1000Hz*
- *Z direction: RMS acceleration 10-6000Hz, 0-Peak acceleration 10-6000Hz.*
- *Temperature*

### Evaluation of LED pureMEMS

If the magnet is held for at least 5 seconds, the diode flashes blue 3 times to indicate that the sensor has received the time waveform command. If the magnet is held for less than 5 seconds, the diode will switch off and the measurement will be limited to trend measurement.

If the diode flashes red, it indicates that the maximum number of triggered time waveform signals has been reached based on the radio rules for the maximum transmission time per day in the LoRa network.

The LED is white during the time that time waveform data is transmitted to the gateway. The transmission time varies depending on the sensor settings and the distance to the gateway. The LED starts flashing white if the sensor has either lost contact with the gateway or if the transmission of data is pending.

If alarm levels are configured, the diode will flash according to:

Green = Ok

Yellow = Warning

Red = Alarm

The diode will flash green if no alarm levels are configured.



*Configuration of sensor properties like alarm levels and facility machine tree structure is done by using pureSignal app. See separate chapter.*

#### Evaluation of LED indications pureMEMS

The LED on the device is an RGB LED and different colours and patterns are used to indicate actual status.

Blue	Solid	The sensor has detected a magnet that is held close to tube.
Blue	Three flashes	A new measurement of time signal will be performed.
Purple	Solid	Measurement in progress.
White	Solid	Upload attempts are in progress.
White	Three flashes	Upload successful.
White	Slowly flashing	Waiting for re-upload attempt.
Green	Flash 10 sec	Trend values were below configured limits.
Yellow	Flash 10 sec	Trend values were above warning and below alarm limits.
Red	Flash 10 sec	Trend values were above alarm limits.
Red	Three flashes	Measurement is blocked.
Red	Six flashes	Upload failed.
Red	Short flash	Sensor failure. Flashing about every 4 seconds.

#### Evaluation of LED indications purePULSE

The LED on the device is an RGB LED and different colours and patterns are used to indicate actual status.

Blue	Solid	The sensor has detected a magnet that is held close to tube.
Purple	Solid	Measurement in progress.
Green	Flash 10 sec	Trend values were below set thresholds.
Yellow	Flash 10 sec	Trend values were above warning, but below alarm limits.
Red	Flash 10 sec	Trend values were above alarm thresholds.

## 10. List of accessories

List of accessories suitable for pureSignal products.

ART NR	TITLE	DESCRIPTION
PS1028	Manual Trigger Magnet	Plastic cover
PS1011	Battery SAFT LS17330	High-performance battery
PS1040	Loctite 454	Glue for flat studs
PS1031	Outdoor Antenna Long Range LoRa WAN	600mm long
PS1038	Screw M6 A4 M6x35	Standard screw for pureMEMS. Stainless Steel
PS1019	Screw M6 A4 M6x40	Extra-long screw. Stainless Steel.
PS1022	M6 -> M8x1,25. 90° Male conical studs	Standard stud for pureMEMS. Suitable with M6x35mm screw. (M8x1,25 90° Male conical)
PS1027	M6 -> Flat Glue studs	Standard stud for pureMEMS. Suitable with M6x35mm screw. (M6 Flat studs)
PS1035	Extension 50mm. Conical M8x1,25 90°	Standard extension for pureMEMS. Suitable with M6x35mm screw. (M8x1,25 90° Male conical) Total extension length 50mm.
PS1036	Extension 100mm. Conical M8x1,25 90°	Standard extension for pureMEMS. Suitable with M6x35mm screw. (M8x1,25 90° Male conical) Total extension length 100mm.
PS3010	Switch Read Sensor M8 1m	RPM trigger sensor with integrated cable 1m. Threads sensor head M8. Spare part for purePULSE.
PS3014	M8 Straight Connector	Mini 4-pin Connector. Spare part for purePULSE and suitable together with PS3010.
	Flat magnet for temporary use	Flat magnet Suitable with M6x35mm screw. Diameter 25mm. Height 15 mm